Claims:

1. A retractable syringe having:

a barrel having a front end, a rear end and defining a receptacle for containing a liquid for injection;

a needle mounted at the front end of the barrel;

a hollow plunger movable within the barrel from the rear end to the front end of the receptacle to expel fluid out of the barrel through the needle;

said plunger having an inner chamber, an axial hole at the front end of the chamber and means blocking the axial hole;

resilient means which is adapted to urge the needle in a rearward direction into the barrel;

wherein said resilient means is restrained by an expandable annular member providing a seal at the front end of the receptacle of the barrel;

the expandable annular member being engaged by a forward part of the plunger when the plunger reaches the front end of the receptacle of the barrel such that the expandable annular member moves towards the front end of the barrel and expands to release the resilient means, whereby the axial hole is unblocked and the needle is automatically retracted through the axial hole into the inner chamber of the plunger, wherein the resilient means in its restrained condition limits movement of the needle under said movement of the expandable annular member to release the resilient means.

2. A retractable syringe as claimed in claim 1, wherein the resilient means is a compression spring, the spring being at least substantially fully compressed when restrained by the expandable annular member, prior to said engagement by the forward end of the plunger.

3. A retractable syringe having:

a barrel having a front end, a rear end and defining a receptacle for containing a liquid for injection;

a needle mounted at the front end of the barrel;

a hollow plunger movable within the barrel from the rear end to the front end of the receptacle to expel fluid out of the barrel through the needle;

said plunger having an inner chamber, an axial hole at the front end of the chamber and means blocking the axial hole;

resilient means which is adapted to urge the needle in a rearward direction into the barrel;

wherein said resilient means is restrained by an expandable annular member providing a seal at the front end of the receptacle of the barrel;

wherein the needle is adapted to engage and at least partially break the means blocking the axial hole to unblock the axial hole when the plunger approaches the front end of the receptacle of the barrel, whereafter continued movement of the plunger towards the front end of the receptacle causes the expandable annular member to move along a surface at the front end of the barrel and expand to release the resilient means, whereby the needle is automatically retracted through the unblocked axial hole into the inner chamber of the plunger.

4. A retractable syringe as claimed in claim 3, wherein the blocking means is positioned at the end of the plunger facing the needle.

5. A retractable syringe as claimed in claim 3, wherein the blocking means is positioned within the plunger.

6. A retractable syringe as claimed in claim 5, wherein the blocking means is positioned within the inner chamber of the plunger.

7. A retractable syringe as claimed in claim 5, wherein the blocking means is positioned within a passageway in the plunger leading to the chamber.

8. A retractable syringe as claimed in claim 3, wherein the plunger and the blocking means are integrally formed.

9. A retractable syringe as claimed in claim 8, wherein said blocking means is formed as a transverse wall member which is joined to the inner periphery of the hole by a region of weakness, such that breaking occurs at that region.

10. A retractable syringe as claimed in claim 9, wherein the wall is joined around its perimeter to the inner periphery of the hole.

11 A retractable syringe as claimed in claim 3, wherein the plunger and the blocking means are discrete components connected together.

12. A retractable syringe as claimed in claim 11, wherein the blocking means is formed as a forwardly convex member positioned on the leading end of the plunger, the convex member including a region of weakness forward of the plunger, such that breaking occurs at the region.

13. A retractable syringe as claimed in claim 12, wherein the convex member is formed of a relatively more brittle material than that of the plunger.

14. A retractable syringe having:

a barrel having a front end, a rear end and defining a receptacle for containing a liquid for injection;

a needle mounted at the front end of the barrel;

a hollow plunger movable within the barrel from the rear end to the front end of the receptacle to expel fluid out of the barrel through the needle;

said plunger having an inner chamber, an axial hole at the front end of the chamber and means blocking the axial hole;

resilient means which is adapted to urge the needle in a rearward direction into the barrel;

wherein the needle is adapted to engage and at least partially break the means blocking the axial hole to unblock the axial hole when the plunger approaches the front end of the receptacle of the barrel, whereafter continued movement of the plunger towards the front end of the receptacle causes the expandable annular member to move along a surface at the front end of the barrel and expand to release the resilient means, whereby the needle is automatically retracted through the unblocked axial hole into the inner chamber of the plunger, wherein the chamber is closed at said remote end by entry thereinto of plug elements formed integrally with the plunger and being attached to the body of the plunger by swingable elements which can be swung from a position at which they extend sidewardly and outwardly of the body to positions at

which these extend inwardly such that the plug elements come together to form the plug, with the so formed plug then closing said opening.

15. A method of forming a barrel structure for a retractable syringe, said barrel structure adapted for use with a syringe plunger having a body with an internal inner chamber, the syringe plunger having a plunger opening at a forward end thereof and communicating with said inner chamber, said plunger opening being formed in a forward abutment portion of the plunger, said plunger being adapted to be slidingly and sealingly accommodated in the barrel structure, for expressing fluid from a forward end of the barrel structure; the method including:

a) forming said barrel structure as a syringe barrel having a cylindrical barrel interior, said barrel having a transverse closure portion at a forward end and being open at an opposite rear end, said closure portion having a needle accommodating opening therethrough, said needle accommodating opening having a first portion open to a forward end of the barrel, and a second portion communicating with the cylindrical barrel interior, said second portion being of greater transverse size than said first portion;

b) forming a hollow fluid conducting needle structure having an elongate needle having a forward skin penetration end and, remote but spaced from an opposite rearward end, an outwardly extending abutment portion, the needle structure being dimensioned such that it can pass into said inner chamber of said syringe plunger from said needle accommodating opening;

c) forming a helical compression spring having an outer diameter greater than the transverse size of said first portion of the needle accommodating opening, less than the transverse size of said second portion of the needle accommodating opening, and less than the transverse size of the plunger opening to permit the spring to enter the said inner chamber with said needle structure, when the plunger is positioned in the syringe barrel, the inner diameter of the spring being smaller than the outer transverse size of the needle structure at said abutment portion, said spring having a compressed state beyond which further compression is at least substantially inhibited;

d) forming a resilient O-ring having in a compressed state an internal diameter such as to resiliently grip an end portion of the needle structure, between the abutment and a rear end of the needle structure, when the O-ring is positioned over the end portion, such as to substantially inhibit relative movement between the O-ring and the needle structure, but which diameter in the compressed state is less than said side to side

dimension of the needle structure at said abutment portion, so that passage of the O-ring over the abutment portion is inhibited, at least in the uncompressed state of the O-ring ; the O-ring in an uncompressed state having an inside diameter such as not to substantially inhibit said movement of the O-ring relative to the needle structure, when the O-ring is positioned over said end portion of the needle structure;

e) forming an annular retaining structure having an outer surface portion adapted to axially slidingly and sealing engage the surface of the cylindrical barrel, a forward transverse surface adapted to sealingly engage an inner face of said closure portion, and a retaining structure opening therethrough extending from said forward transverse surface to a rear transverse surface of the retaining structure, said retaining structure opening having a first portion opening to said forward transverse surface, having a transverse size such as to accommodate said O-ring in said uncompressed state, a second portion of diameter less than the external diameter of said O-ring in said compressed state and greater than the transverse size of said abutment portion of said needle structure but such as to permit passage of said needle structure and said spring therethrough, and an intermediate portion between said first and second portions adapted to retain said O-ring therein in said compressed state;

f) assembling said spring, said needle structure, said O-ring and said retaining structure in said barrel by entering these into said barrel from said rear end whereby the penetration end of the needle is passed through said needle accommodating opening in said closure portion to forwardly project therefrom, and the spring is accommodated in said second portion of said needle accommodating opening in abutment with a step between the first and second portions of the needle accommodating opening, and extends into said first portion of said retaining structure opening, and with the needle structure extending through said spring, said O-ring being between said abutment portion and a step between the first and intermediate portions of said retaining structure opening;

g) during said assembling, said retaining structure being advanced towards said forward end of the barrel so as to substantially engage the inner face of said closure portion, compress said spring substantially to its compressed state, and cause said O-ring to be retained between said abutment portion and a step in the retaining structure opening, while leaving an annular gap between the periphery of the abutment portion and a peripheral edge of said step, whereby the needle structure may be urged by said spring acting against said abutment portion to pass rearwardly through said retaining structure opening and into said inner chamber via said plunger opening, by advancing said plunger

in the barrel such that said abutment portion of the syringe plunger enters said second portion of said retaining structure opening to express said O-ring through said gap into said first portion of the retaining structure opening, to effect release of said gripping.

16 A method of forming a barrel structure for a retractable syringe, said barrel structure adapted for use with a syringe plunger having a body with an internal inner chamber, the syringe plunger having a plunger opening at a forward end thereof and communicating with said inner chamber, said plunger opening being formed in a forward abutment portion of the plunger, said plunger being adapted to be slidingly and sealingly accommodated in a the barrel structure of the barrel structure, for expressing fluid from a forward end of the barrel structure, said barrel structure having a syringe barrel, a fluid conducting needle assembly, a helical compression spring, a resilient O-ring and an annular retaining structure;

said barrel structure having a syringe barrel having a cylindrical barrel, said barrel interior said barrel having a transverse closure portion at a forward end and being opened at an opposite rear end, said closure portion having a needle accommodating opening therethrough, said needle accommodating opening having a first portion open to a forward end of the barrel, and a second portion communicating with the barrel interior, said second portion being of greater transverse size than said first portion;

said needle structure having an elongate needle having a forward skin penetration end and, remote but spaced from an opposite rearward end, an outwardly extending abutment portion, the needle structure being dimensioned such that it can pass into said inner chamber of said syringe plunger from said needle accommodating opening;

said helical compression spring having an outer diameter greater than the transverse size of said first portion of the needle accommodating opening, less than the transverse size of said second portion of the needle accommodating opening, and less than the transverse size of the plunger opening to permit the spring to enter the said inner chamber with said needle structure, when the plunger is positioned in the syringe barrel, the inner diameter of the spring being smaller than the outer transverse size of the needle structure at said abutment portion, said spring having a compressed state beyond which further compression is at least substantially inhibited;

said resilient O-ring having in a compressed state an internal diameter such as to resiliently grip an end portion of the needle structure, between the abutment and a rear end of the needle structure, when the O-ring is positioned over the end portion, such as to

substantially inhibit relative movement between the O-ring and the needle structure, but which diameter in the compressed state is less than said side to side dimension of the needle structure at said abutment portion, so that passage of the O-ring over the abutment portion is inhibited, at least in the uncompressed state of the O-ring; the O-ring in an uncompressed state having an inside diameter such as not to substantially inhibit said movement of the O-ring relative to the needle structure, when the O-ring is positioned over said end portion of the needle structure;

said annular retaining structure having an outer surface portion adapted to axially slidingly and sealing engage the surface of the cylindrical barrel, a forward transverse surface adapted to sealingly engage an inner face of said closure portion, and a retaining structure opening therethrough extending from said forward transverse surface to a rear transverse surface of the retaining structure, said retaining structure opening having a first portion opening to said forward transverse surface, having a transverse size such as to accommodate said O-ring in said uncompressed state, a second portion of diameter less than the external diameter of said O-ring in said compressed state and greater than the transverse size of said abutment portion of said needle structure but such as to permit passage of said needle structure and said spring therethrough, and an intermediate portion between said first and second portions, adapted to retain said O-ring therein in said compressed state,

said method including:

assembling said spring, said needle structure, said O-ring and said retaining structure in said barrel by entering these into said barrel from said rear end whereby the penetration end of the needle is passed through said needle accommodating opening in said closure portion to forwardly project therefrom, and the spring is accommodated in said second portion of said needle accommodating opening in abutment with a step between the first and second portions of the needle accommodating opening, and extends into said first portion of said retaining structure opening, and with the needle structure extending through said spring, said O-ring being between said abutment portion and a step between the first and intermediate portions of said retaining structure opening; and

during said assembling, said retaining structure being advanced towards said forward end of the barrel so as to substantially engage the inner face of said closure portion, compress said spring substantially to its compressed state, and cause said O-ring to be retained between said abutment portion and a step in the retaining sructure opening, while leaving an annular gap between the periphery of the abutment portion and a

peripheral edge of said step, whereby the needle structure may be urged by said spring acting against said abutment portion to pass rearwardly through said retaining structure opening and into said inner chamber via said plunger opening, by advancing said plunger in the barrel such that said abutment portion of the syringe plunger enters said second portion of said retaining structure opening to express said O-ring through said gap into said first portion of the retailing structure opening, to effect release of said gripping.

17. A barrel structure for a syringe having a forwardly extending needle structure which is retractable into the interior of the syringe under influence of a spring which is released from a loaded condition by displacement of a holding means by forward movement of a plunger of the syringe, the holding means in the loaded condition inhibiting substantial forward movement of the needle structure when the plunger is moved to displace the holding means.

18 A barrel structure as claimed in claim 17 wherein said spring is a helical compression spring which, in the loaded condition, is substantially fully compressed.

19. A barrel structure as claimed in claim 17 or claim 18 wherein the holding means is a resilient expandable annular member which in the loaded condition is held radially compressed in an opening of the barrel structure so as to resiliently grip a portion of the needle structure, said release being effected by release of said compression by contact of the resilient annular member with an abutment portion of the syringe plunger, under forward movement of the syringe plunger.

20 A barrel structure as claimed in claim 20 wherein said opening is formed in an annular retaining structure in a barrel of said syringe barrel structure.

21. A syringe having a barrel structure as claimed in any one of claims 17 to 20 in combination with said plunger.

22. A retractable syringe having a forwardly extending needle structure which is retractable into a chamber in a plunger of the syringe under influence of a spring which is released from a loaded condition by displacement of a holding means by forward movement of the plunger, the plunger having a forward opening for passage of the needle

structure into said chamber, said opening being closed by a frangible part which is contacted and at least partially broken by the needle structure during said forward movement of the plunger, whereafter the holding means is displaced to permit the needle structure to enter the chamber.

23. A retractable syringe as claimed in claim 22 wherein said chamber is closed at an end of the plunger remote from said forward opening by plug elements that are integrally formed with the plunger.

24. A retractable syringe as claimed in claim 23 wherein said plug elements are formed of opposed arms hingedly connected to the body portion, such that the plug elements can be entered into said remote end of the plunger by inward swinging of the arms to enter the plug elements into said remote end.

25. A method of forming the syringe barrel structure claimed in claim 19, including entering said needle structure in said barrel structure so as to bring said holding means from an unloaded to a loaded condition, such that the annular member effects said gripping.